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ABSTRACT

Since 1988, Massachusetts' Massasoit Community College has offered two alternative introductory algebra courses for students receiving low scores on mathematics admission tests. One alternative course provides 5 hours of instruction per week, rather than the 3 hours per week in the traditional course, while the other segments the traditional course syllabus into three 1-credit units taught by separate teachers. A study was undertaken to gather data on the characteristics of students taking alternative courses since 1990 and to compare outcomes for students in alternative and traditional courses. The study sample consisted of 436 students taking the traditional course in 1993 (Group 1), 360 students who completed the segmented modules since 1990 (Group 2), and 212 students who completed the 5-hour-per-week course since 1990 (Group 3). Study findings included the following: (1) in general, Group 2 students were less likely to fail and more likely to pass the introductory algebra course than either Group 1 or Group 3 students; (2) 223 of the Group 2 students passed and 53 failed, while 237 passed and 134 failed from Group 1 and 87 passed and 65 failed from Group 3; and (3) Group 2 students did, however, have a higher mean grade point average for all coursework (2.27) than both Group 1 students (2.26) and Group 3 students (1.91). (MAA)

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ALTERNATIVE DELIVERY SYSTEMS FOR INTRODUCTORY ALGEBRA

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INTRODUCTION AND BACKGROUND

From the fall of 1988, the department of Mathematics of the Science Division at Massasoit Community College began to offer two non-traditional Algebra courses called 5-day Algebra and Algebra Modules, in addition to the traditional Introductory Algebra. Since this time, 761 students have taken either non-traditional course.

Both traditional and non-traditional Algebra courses cover the same amount of material. In addition, instructors who teach the traditional Algebra also teach the non-traditional methods. These three courses are distinguishable, however, in terms of approach.

Briefly, the 5-day Algebra course presents Introductory Algebra material in a 5-hour a week schedule as opposed to a 3 hour a week schedule.

Algebra Modules segments the course syllabus into three one credit parts taught by three separate teachers. Satisfactory completion of one segment, called a module, is achieved through taking two tests. Satisfactory completion of the course requires completion of three modules and the passing of six corresponding tests in the period of one or two semesters.

Students are advised to take one of the non-traditional courses if they receive a low score on the mathematics admissions test which is taken at freshman orientation.

Although there is sufficient enrollment in these courses every semester to justify offering these non-traditional approaches, the matriculation rate of these courses has never been evaluated. In addition, no analyses have been performed to evaluate the success of students who take one of these non-traditional approaches as compared to the traditional Algebra course.

The intention of this paper is to provide data concerning students who have taken non-traditional Algebra courses since 1990. In addition to scoring low on pre-admission Arithmetic tests, trends in GPA, ethnicity, gender and other characteristics may become apparent through descriptive statistics. Finally, this paper will test the hypothesis that students who opt for the alternative delivery system will be more likely to receive a passing grade in Introductory Algebra than those students who take the more traditional methods.

Table I

Number of Students Taking Non-Traditional Algebra since 1990

	Number Taking Course	Number Passing	% Pass
5-day Algebra	232	87	38%
Algebra Modules	529	292	55%

METHODOLOGY

Information on mathematics course offerings since 1990 was obtained from Computer Operations at Massasoit Community College. Students who had taken an alternative mathematics course since 1988 were included in this file. Information on ethnicity, age and gender was obtained through admissions records. Academic information, such as course grade, grade point average and test scores was also obtained.

Data were analyzed using SPSS software for the Social Sciences. Analyses include descriptive statistics, such as frequency and means when appropriate.

To compare the non-traditional vs. traditional approaches, researchers compared students taking traditional Algebra in 1993 with those students taking non-traditional classes since 1990. Group 1 is composed of 436 students who took traditional Algebra during 1993. Group 2 is made up of 360 students who took and completed Algebra Modules in one semester after 1990. Group 3 is made up of the 212 students who took 5 day Algebra after 1990.

The success rates of students taking Algebra Modules as compared to traditional Algebra were evaluated using the non-parametric Chi Square Test. Differences between the three groups in regards to other demographic factors were assessed using one of two methods. Categoric variables, such as race and gender, were analyzed by the non-parametric Chi Square Test. Continuous variables, such as age and test scores, were analyzed by the One-Way Anova Method with the Tukey and Sheffe's post hoc tests.

In order to control for individual teaching styles, the study only includes those students who took traditional Introductory Algebra from a teacher who also teaches the non-traditional courses. Therefore, all three groups cannot be distinguished by teachers.

CONCLUSIONS

Table II below presents the results of a Chi Square test comparing the success rates of students in each of the three groups. According to the Chi Square test, the three test groups varied significantly in regards to passing or failing.

The first number in Table II represented the observed data, while the second number in parentheses represents the expected data.

Table II

The Success Rates of Students In Three Study Groups

	Failed	Passed	Missing
Algebra Modules	53 (95.3)	223 (191.6)	84 (73.2)
Traditional Algebra	134 (115.4)	237 (232)	65 (88.6)
Five Day Algebra	65 (52.0)	87 (111.8)	60 (48.3)

Key: Observed (expected)

Table III below presents the data in Table II by marking which groups are distinguishable in terms of performance, evaluated dichotomously as pass and fail.

Table III

The Success Rates of Students In Three Study Groups

	Failed	Passed	Missing
Algebra Modules			
Traditional Algebra			
Five Day Algebra			

more than expected

fewer than expected

Table III above shows that those students who have taken Algebra Modules were less likely to fail, and more likely to pass than those taking either the traditional Algebra or the Five Day Algebra. These results are statistically significant.

DISCUSSION

In addition to intensive teaching provided by Algebra Modules, other factors may contribute to the success of this group.

Table IV below suggests that those who take Algebra Modules are slightly younger than those who take the traditional course. Younger students may have more recent experience with Algebra in high school.

Table IV

Mean Age Of Study Groups

	MEAN AGE	Significantly Different
Algebra Modules	26.3859	Five Day Algebra
Traditional Algebra	27.9132	Five Day Algebra
Five Day Algebra	28.1628	

Analyses suggest that the three groups did not differ by gender. Table V suggests that gender is not a confounder.

Table V

Gender and Three Groups

	Male	Female	Significantly Different
Algebra Modules	157	203	none
Traditional Algebra	197	239	none
Five Day Algebra	120	112	none

Several characteristics inherent in the study groups actually strengthens the finding that those students taking Algebra Modules are more likely to have a positive outcome.

One can argue that the three groups may differ by GPA, and that students in one group may have higher academic aptitude. However, as shown below in Table VI, those who take Algebra Modules are more likely to have a GPA above a "C". This finding is important because it indicates that the success of these students in Algebra Modules, can in part, be attributed to a higher than average performance in most classes.

Table VI

Mean GPA
Of Study Groups

	MEAN GPA	Significantly Different From
Algebra Modules	2.27	Five Day Algebra
Traditional Algebra	2.26	Five Day Algebra
Five Day Algebra	1.91	-

In this analysis, students taking 5-Day Algebra did not differ from traditional algebra in terms of outcome. One might be tempted to suggest that this finding may indicate that Algebra Modules is a more appropriate and successful non-traditional approach to Introductory Algebra. However, demographically speaking, 5-Day Algebra appears to experience special challenges because of a more diverse population. As Table VII indicates, 5-Day Algebra has a significantly higher number of non-white students as compared to white students. Non-white students may be more likely to fail or withdraw than white counterparts.

Table VII Ethnicity and Three Groups			
	White	**Non-White**	**Significantly Different**
Algebra Modules	311 (291.2)	34 (44.2)	more whites than expected
Traditional Algebra	358 (351.9)	51 (53.4)	more whites than expected
Five Day Algebra	161 (186.9)	41 (28.4)	more non-whites than expected
Key: Observed (expected)			

There is yet another way to explain why students taking 5-Day Algebra are less likely to succeed when compared to students taking Algebra Modules. Below in Table VIII it is evident that those students taking 5-Day Algebra score lower than the other two groups on pre-admissions test both in Algebra and in Arithmetic. The students taking 5-Day Algebra, simply based on incoming scores, would be less likely to have a better Algebra outcome.

Table VIII Test Scores and Three Groups				
	Algebra Score	**Arithmetic Score**	**Essay Score**	**Read Score**
Algebra Modules	10	25	3	29
Traditional Algebra	17	26	6	19
Five Day Algebra	7	19	3	23

Conclusions

The analyses suggest that those students taking Algebra Modules at Massasoit Community College are more likely to succeed than those taking 5-Day Algebra or traditional Introductory Algebra. This finding is strengthened when factors such as age and GPA are considered.

Though students taking 5-Day Algebra are not as likely to succeed as those students taking Algebra Modules, this may be due to factors such as race and incoming mathematics aptitude.

Although 5-Day Algebra students are less likely to succeed than the Algebra Module students, this finding must be considered in context. First, 5-Day Algebra students have the lowest baseline arithmetic and algebra scores than any other group. They are also more likely to be non-white. All these factors may account for a poorer outcome. What is significant in this regard is that those students taking 5-Day Algebra, despite these issues, are no more likely to fail Algebra than the traditional Introductory Algebra students who are more likely to be white and are more likely to score higher on the pre-admissions tests.

It is important to note that these analyses are based on those who completed Algebra Modules in one semester. Students have two semesters to complete the course successfully. Success or failure in subsequent semesters was not considered.

Future research should focus on subsequent semesters of Algebra Modules to assess if this outcome improves with time. In addition, future studies should focus on students from each of these three groups

who go on to take advanced mathematics. Performance in other classes would help us to define or measure the success of these courses.